wood has found *Pelonaia* in some numbers in the intestine of the common dab.

Amongst anemones, *A. mesembryanthemum* is certainly a favourite food of the cod, and is not uncommon on the carapace of *Cancer pagurus*. It is difficult to see in what way the anemone is there protective to the crab. Both young crabs and anemones (of this and some other species) are equally preyed on by the cod; and though the crab may perhaps be big enough (as in a recent specimen 5 inches broad) to enjoy immunity from the cod's attack, yet, by parading such a gaudy bait, it must at least run the risk of a severe shaking. It may be added that, in the last-named case, the anemone quitted the crab, when moribund, for a more desirable basis.

Ernest W. L. Holt.

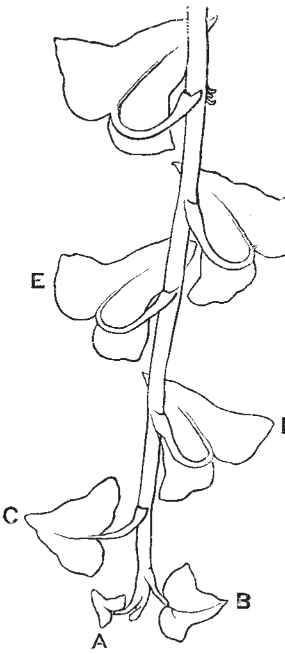
St. Andrews Marine Laboratory, N.B., March 9.

Abnormal Shoots of Ivy.

The accompanying sketch represents a condition which is exhibited by a certain group of ivy plants in the neighbourhood of Plymouth. The plants are rooted upon the top of a high bank, which bounds the southern side of the road from Mount Edgcumbe to Tregantle; the branches pass downwards from the top of the bank on to its northern side.

The young shoots of each plant are conspicuous, because their leaves appear red, and so contrast strongly with the green of the older leaves. This appearance is due to the fact that the lower surface of each leaf is uppermost.

The sketch represents the terminal portion of a young shoot. The growing point is directed downwards. The three terminal leaves, A, B, C, have their upper surfaces directed upwards. The leaves beyond these, however (D, E, &c.), are twisted in a twofold way. First, each leaf-stalk is twisted on its own axis, so that the lower side of the leaf is directed upwards; and secondly, the apex of each leaf is rotated through 180°, so that it points away from the growing point of the shoot which bears it, towards the root.



This twisted condition is exhibited by about twelve or fourteen leaves on every young shoot—say, through a dozen inches from the growing point. The older leaves lose both kinds of torsion, so that each old leaf has its upper side uppermost, and its apex is directed towards the growing point of the stem. The under sides of the older leaves have completely lost their red colour.

The condition described is exhibited by all the shoots of a plexus of ivy plants just beyond the fifth milestone from Mount Edgcumbe, on the road above mentioned. It is absent in all the many bushes and creeping masses of ivy which grow on the same bank of the road between this point and Mount Edgcumbe. Whether all the plants composing the abnormal plexus are the offspring of a single parent cannot now be determined.

Plymouth, March 10. W. F. R. Weldon.

Earth-Currents and the Occurrence of Gold.

Gold has been so large a factor in the prosperity and greatness of Australia, that the interesting subject of the origin of gold drifts and reefs must always possess to us something more than a purely scientific attraction. In the earlier days of the goldfields there was among the diggers much speculation, of a scientific and semi-scientific nature, as to the processes by which Nature had produced the accumulations of coarse and fine gold dust which it was their business to extract from the alluvial drifts. The most obvious explanation, of course, was that the grains of gold had an origin similar to that of the *débris* and detritus of various characters which made up the alluvium itself; and this explanation seemed to harmonize so completely with the general processes of Nature that at one time it was almost universally accepted as the correct one. But many thoughtful mining authorities had their doubts upon the subject, and these doubts were not founded, as so frequently happens, upon mere prejudice, but were fortified by the fact that certain phenomena characteristic of the occurrence of drift gold were not only not explained by the "detrital hypothesis," as it is called, but were absolutely inconsistent with it. Chief among these objections may be mentioned the undoubted generalization that drift gold is nearly always purer than the gold in the reefs of the neighbourhood in which it occurs. No explanation as to the long distances to which grains of gold might be conveyed, or to the possible purifying effects of natural chemical action, made up any satisfactory explanation of the known facts, and accordingly under the detrital theory these facts had to remain shrouded in mystery. Then, again, it was a frequent occurrence for gold to be found so peculiarly embedded in pieces of wood, or in conjunction with natural crystals of minerals, such as the sulphides, that those who were constantly being brought into contact with such phenomena were firmly convinced that at all events there was a certain proportion of the gold found in alluvial drifts which had its origin in some other source than the breaking down of quartz reefs by the ordinary processes of Nature. The majority of those who held to this belief had at first but little scientific knowledge of natural reactions; and when questioned as to their theory on the subject, they were accustomed to say of the alluvial drift-gold, that it appeared to be actually growing—a statement which sometimes provoked, not unnaturally, a smile of pity for misplaced credulity.

These objectors, however, were right. Of this there is now scarcely the shadow of a doubt. It would be tedious to trace the steps by which such a strange conclusion has come to be virtually established. Suffice it to say that at the present day there are but few scientific men in Australia who have studied the subject who do not hold that by some agency or another the gold that is in our alluvial drifts has been formed, and probably is at present accumulating at the present moment, in its present position. It seems probable, indeed, that drift gold has its origin in the salts held in solution by the water by which it was formerly supposed to have been merely carried from one place to another. The most common salt of the precious metal is chloride of gold; and of this salt there is an appreciable quantity present in sea water along with the common sea salt, which, of course, is mainly chloride of sodium. In geological epochs, when the rocks of our present gold-fields were submerged below the ocean, and later on, when they held upon their surfaces vast imprisoned lakes of salt water, it is probable that they became saturated with sea water and retained large amounts of gold in solution. According to a computation quoted by Mr. Skey, the Government Geological Analyst for New Zealand, it is probable that every cubic mile of rock contains something like a million ounces of gold. Hence the underground streams of Australia, in certain districts, are particularly rich in salts of the precious metal, and there is an enormous area over which slight quantities of gold can always be obtained, while surface streams which are fed by deep-seated springs accumulate gold upon alluvial flats and hollows. Some of the gold found in such streams may undoubtedly be ascribed to the destruction of quartz reefs. It stands to reason that these reefs, like other rocks, must contribute to the *débris* in the beds of rivers and streams. But most of the purer alluvial coarse gold has evidently a different origin.

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Up to this point, the new explanation of the origin of drift gold seems feasible, and, indeed, almost conclusive. The gold is present in minute quantities in the water of the drift, and this fact has been conclusively demonstrated experimentally by various investigators, among whom may be mentioned Messrs. Newberry and Skey. But it is one thing to prove that chloride of gold exists in the drift waters, and quite another thing to suggest in what manner and by what agency the precious metal has been reduced from its salt, and deposited in the form of coarse or fine grains or in that of large and strangely-shaped nuggets. Precipitation was the first and most obvious suggestion. The addition, for instance, of a minute quantity of sulphate of iron to a solution of chloride of gold would cause the formation of minute particles of metallic gold, and sulphate of iron, of course, is present in Nature abundantly. But such an explanation would only account for the formation of the very finest gold dust. It would give no solution of the origin of coarse gold and nuggets, nor would it account for any of the many peculiar anomalies of which I shall presently mention some striking examples.

In order to afford a possible extension of this purely chemical theory which might give a clue to the origin of nuggetty gold, it has been pointed out that if a crystal of some sulphide, such as iron pyrites, be immersed in a solution of chloride of gold, it will be covered with a film of metallic gold. Following the track of investigation thus apparently opened up, it has been ingeniously suggested that possibly the material of the metallic sulphide, and that of the golden film, may be regarded as a sort of miniature electric battery, in which the gold would form one anode and the pyrites the other. A current would pass between the two, and the result would be the deposition of metallic gold upon the film, at the same time that the material of the pyrites would continually become decomposed. The electroplater, in his laboratory, places the salt of gold in his bath, and uses an ordinary battery from which to obtain a current sufficiently strong to deposit gold upon the articles to be plated. But in this case it was suggested that the article to be plated, which was the film of gold itself, might be regarded as one of the elements supplying the current. The theory seems from the outset somewhat far-fetched, and it is open to very strong objections on the ground of improbability. The amount of material which the electroplater has to use up in order to deposit an ounce of gold is very considerable, even in the most efficient forms of batteries known to science. It is scarcely conceivable that a piece of pyrites, weighing about two pennyweights, would, by its decomposition, afford sufficient current to deposit an ounce of gold. Yet something of the sort would have to be established before it could be proved that electro-chemical action *in situ* supplies the electric current as a reducing agent.

In seeking for an explanation of the deposition of gold which would afford a surer or more probable basis for conjecture, I was at first mainly influenced by two remarkable facts which could hardly be referred to any imaginable phenomena of a chemical or electro-chemical origin. These were that in a drift supplying gold in abundance it is by no means uncommon to find a patch in which the gold gives out altogether, and is picked up further along the line; and the second was that there has always been observed at many of the leading goldfields a certain correspondence between the richness of the alluvial drifts and reefs and the points of the compass. The direction in which the richest drifts run may vary from one locality to another. But no matter how broken in contour the country may be, there is almost always a marked parallelism between the richest drifts.

Taking these and one or two other facts as a starting-point, I was led to form the hypothesis that the probable origin of the deposition of gold is to be found in thermo-electric earth-currents, probably generated by the unequal heating of the surface of the earth by the sun's rays in passing from east to west. This theory of earth-currents has attracted a good deal of attention in Australia, and it is remarkable how rapidly facts in support of it have been brought forward during the past few months. It would be impossible for me, within brief limits, to refer to all of these; but it will be of interest to summarize a few of the leading points:—

(1) The existence of earth-currents has been frequently demonstrated, and has attracted special attention since the invention of the telephone. In 1880, Prof. Trowbridge, of Harvard, conducted a series of experiments at the Observatory, and recorded it as one of his results that these currents appeared to be most pronounced along the water-courses.

(2) In Victoria remarkable instances of deflection of the compass have been particularly numerous, hinting at the presence of strong currents, more especially at the lines of junction between permeable and impermeable rocks.

(3) There is a remarkable relation between the conductivity of the adjacent rock country and the richness of an alluvial drift. Thus, in passing through slate or below an overhanging mass of basalt, the drift is generally richer than in passing through moist sandstone, suggesting that, where an earth-current is concentrated along the line of the water in consequence of the presence of rocks of low conductivity, the process of deposition has been facilitated.

(4) There are places at which the gold gives out altogether, although no discernible change has taken place in the nature of the country. These places seem to be the localities of a sort of short-circuiting, which we may readily suppose to take place very frequently in earth-currents.

(5) At particular pinched localities the current would be peculiarly strong, and would lead to the formation of nodules or nuggets of gold, the existence of which cannot be satisfactorily explained by any chemical theory hitherto advanced.

(6) Nuggets of an alloy of gold and copper have sometimes been met with, and the two metals have even been found to lie in alternate layers, suggesting that at one time a copper salt, and at another a gold salt, has been subjected to the action of a reducing current.

(7) In presence of a large amount of organic matter, it is almost invariably found that a drift becomes especially rich. The formation of acid by decomposition is what would be peculiarly required to facilitate the passage of an earth-current through the water of an underground drift, the existence of free acid being the requirement for an artificial electro-depositing bath.

(8) Conversely, the vicinity of large masses of calcite has been observed to be most inimical to the richness of a drift, and, of course, this could be explained by the fact that the carbonate of lime would destroy the free acid, and reduce the conductivity of the water so as to impede the transmission of a current.

(9) The peculiar shapes of the grains of what is known as coarse gold, are very suggestive of the action of a feeble current in piling up the metal upon the prominent portions, and leaving deep indentations between. Electric action of an extraneous nature is also strongly indicated by the strange strings and filaments which are constantly being met with.

(10) If we accept the crenitic theory of the origin of quartz reefs, the theory of earth-currents would at once apply with particular force to show how the action of such currents in hot siliceous solutions would produce a formation of gold simultaneous with that of quartz, thus accounting for the finely divided state of the gold in such reefs.

(11) At the same time it is necessary to account for the existence of the large masses of gold which are sometimes found associated with quartz, at places where the reefs become narrow in pinched localities. The theory of precipitation cannot account for these. But that of earth-currents would naturally lead us to expect the phenomenon, because in such a locality, while the formation of quartz would be retarded, the formation of gold would be accelerated by the concentration of the current as already explained.

The hypothesis is thus well supported by *primâ facie* evidence. For the experimental detection of earth-currents on goldfields I have strongly recommended the close observation of the most minute deflections of the magnetic needle, especially in underground workings. I believe also that the use of the telephone, as in Prof. Trowbridge's experiments, will be of great service in indicating the lines of greatest conductivity in the earth's crust, and in enabling us to decide whether these are identical in goldfields with those lines in which the drifts contain the richest gold.

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THE PRIMITIVE TYPES OF MAMMALIAN MOLARS.

SO much light has recently been thrown on the origin and mutual relations of the Mammalia by the labours of the Transatlantic palæontologists, that in the case of the limbs we have long since been able to trace the evolution of the specialized foot of the Horse from

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